Graduate Research Center
of Southwest

PROGRESS REPORT ON
"INVESTIGATIONS INTO THE MECHANISM AND RATES OF
ATMOSPHERIC MIXING IN THE LOWER THERMOSPHERE"
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The effects of eddy mixing in the lower thermosphere on atmospheric composition have been evaluated for a number of different conditions. A range of eddy diffusion coefficients from 2 to 8 x 10^6 cm^2/sec, coupled with dissociation and recombination rates, can be expected to produce atomic to molecular oxygen rates at 120 km ranging from 2 to 0.5, which appears to bracket the observational data. Calculations have been made of the vertical distribution of helium and argon, and it is found that the base of diffusion equilibrium is about 10 km higher for argon than for helium for a given intensity of eddy mixing.

Since the intensity of eddy mixing is a primary cause of changes in atmospheric structure, and the change in the level of the base of diffusion equilibrium is only a description of a change that has occurred, it is recommended that atmospheric models be characterized by the intensity of eddy mixing rather than by the height of the turbopause. The importance of this recommendation is emphasized by the fact that the intensity of eddy mixing is the same for all atmospheric constituents, whereas the height of the turbopause differs from one constituent to another, depending upon the molecular diffusion coefficient.

The calculations on helium and argon indicate that they are suitable constituents to use in evaluating the intensity of eddy mixing. Although detailed calculations have not yet been made for atomic hydrogen, it appears that it will not be a useful constituent in this regard. This arises because the escape of atomic hydrogen from the exosphere is relatively rapid, and diffusive flow through the thermosphere must be so rapid that the hydrogen distribution follows the average atmospheric scale height rather than a scale height characteristic of the atomic weight unity. Under these conditions, mixing should not influence the distribution significantly. Detailed calculations are in progress to check this point.

Internal gravity waves are being studied to evaluate their intensity in the lower thermosphere and to identify the mechanisms by which eddy